

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Climate Change

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		5%	
111	Conservation and Efficient Use of Water	5%		5%	
112	Watershed Protection and Management	5%		5%	
122	Management and Control of Forest and Range Fires	5%		5%	
123	Management and Sustainability of Forest Resources	0%		5%	
132	Weather and Climate	5%		5%	
133	Pollution Prevention and Mitigation	5%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
202	Plant Genetic Resources	5%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%		10%	
205	Plant Management Systems	10%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		10%	
212	Diseases and Nematodes Affecting Plants	10%		10%	
213	Weeds Affecting Plants	5%		3%	
216	Integrated Pest Management Systems	10%		5%	
404	Instrumentation and Control Systems	5%		2%	
605	Natural Resource and Environmental Economics	5%		5%	
610	Domestic Policy Analysis	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	18.0	0.0	65.0	0.0
Actual Paid	20.0	0.0	88.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
153798	0	388697	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
153798	0	388697	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
2983575	0	7957171	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and outreach will be conducted to facilitate conversion of agricultural, forestry, and industrial waste streams into clean energy and stable construction grade materials. This includes development of new products and transfer of associated technology to the private sector. Delivery of information to the general public will continue to be a high priority.

Our plant breeding and molecular biology programs will continue to develop new crop varieties that are able to withstand emerging disease and pest threats associated with climate change. We will investigate the possibilities that changed climatic conditions might present opportunities for growing new crops or growing traditional crops in new ways or new areas.

We will assess climate change related policies and develop research and outreach programs to position Washington's agriculture and forestry industries effectively to increase sequestration of carbon and to benefit from future carbon trading protocols or other greenhouse gas mitigation policy mechanisms.

2. Brief description of the target audience

Owners and managers of livestock and crop farms, forest resources, and wood products industries; community leaders; and public agencies and organizations.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	12685	5615	115	35

2. Number of Patent Applications Submitted (Standard Research Output)

Patent Applications Submitted

Year: 2014
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	10	33	43

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops and other educational events delivered on mitigation and adaptation to climate change.

Year **Actual**
 2014 35

Output #2

Output Measure

- Number of peer reviewed (official) WSU Extension publications referencing climate change mitigation and adaptation published per year.

Year **Actual**
 2014 2

Output #3

Output Measure

- Number of graduate students with a significant professional orientation in the area of Climate Change.

Year	Actual
2014	39

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives on mitigating or adapting to climate change.
2	Percentage of evaluated program participants who applied knowledge or technology gained from WSU on mitigating or adapting to climate change.
3	Number of farms utilizing WSU-developed crop varieties and/or other technologies to adapt to evolving environmental conditions or newly emerging plant pests and diseases.
4	Number of farms employing anaerobic digestion or other methods to reduce GHG emissions or to sequester carbon.

Outcome #1

1. Outcome Measures

Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives on mitigating or adapting to climate change.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The impacts of climate change on Washington State could be significant, with potential changes in irrigation water availability as well as growing conditions for crops statewide. The impacts of climate change on Washington State could be significant, with potential changes in irrigation water availability and seasonal growing conditions for crops statewide. New plant and animal pests and diseases are likely to emerge over time as well. These and other factors will impact communities, agriculture and natural resource management, navigation, and electrical generation in the state.

What has been done

Program implementation utilized local, regional, and statewide efforts that involved anaerobic digester research; 35 outreach educational programs; print and electronic publications; and other methods to disseminate research-based knowledge and other relevant information to target audiences. A team of researchers also investigated how water resources can be better managed in response to climate change induced scarcity and variability of water supply for agriculture

Results

Program evaluations revealed that an average of 75 % of program participants increased their knowledge and awareness of climate change mitigation and/or adaptation practices. This knowledge included basic understanding of climate change and steps to adapt to future changes and mitigate trends that are predicted.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
404	Instrumentation and Control Systems
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

Outcome #2

1. Outcome Measures

Percentage of evaluated program participants who applied knowledge or technology gained from WSU on mitigating or adapting to climate change.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	29

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

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What has been done

Program implementation utilized local, regional, and statewide efforts that involved anaerobic digester research; 35 outreach educational programs; print and electronic publications; and other methods to disseminate research-based knowledge and other relevant information to target audiences. A team of researchers also investigated how water resources can be better managed in response to climate change induced scarcity and variability of water supply for agriculture.

Results

Twenty-nine percent of program participants indicated and intent to apply the knowledge gained from one or more of the 35 educational events delivered in this program area. This application assessment was significantly lower than the previous year's evaluation showing a 55% application of knowledge gained. While the metric for knowledge gained increased from the previous year, it is unclear why the application of this knowledge declined among program participants. This seems to imply that a greater reluctance among program participants to act on the information and recommendations provided, and may be linked to the financial cost of implementation or other considerations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Diseases and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
404	Instrumentation and Control Systems
605	Natural Resource and Environmental Economics

610 Domestic Policy Analysis

Outcome #3

1. Outcome Measures

Number of farms utilizing WSU-developed crop varieties and/or other technologies to adapt to evolving environmental conditions or newly emerging plant pests and diseases.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of farms employing anaerobic digestion or other methods to reduce GHG emissions or to sequester carbon.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	67

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farm and processor waste estimated to be 17 million tons annually can lead to major unproductive releases of fixed carbon as carbon dioxide and methane. By using anaerobic digestion (AD) to recover some of the energy content of this waste, less fossil fuel is needed and the energy associated with waste disposal is reduced. The economics of AD operations in animal production in Washington is best when tipping fees for disposal of other waste products are also available.

What has been done

WSU scientists have conducted extensive research on anaerobic digestion (AD) as a technology to recover methane (energy), stable carbon, and nutrients from organic wastes such as manure, food processing wastes and the organic fraction of municipal solid wastes. We have evaluated the technical and economic performance of commercially available systems, developed improved AD reactors, and commercialized WSU patented nutrient recovery technology.

Results

Sixty-seven farms are employing methods to reduce GHG emissions, and 22 commercial farm-based AD projects are now operating in the PNW (WA, OR, ID), processing over 7800 tons of organic waste daily. Four commercial scale nutrient recovery facilities have been installed nationally based on WSU patented technology. Data was collected from survey of project developers and estimates based on existing research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation
205	Plant Management Systems
404	Instrumentation and Control Systems
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

There are numerous factors that influence our work on climate change. There is some resistance to the idea of climate change and some of our stakeholders are unwilling to accept this type of research and outreach as valuable or needed. Additionally, as in many of our programs, there were reduced baseline appropriations from the state to support our work. However, the concept of "climate change" as applied to marginal growing conditions has always been important in Washington State and we have traditionally and much more so recently, sought grants and outside investments that have allowed this program to move forward, in spite of political opposition to the issue of climate change.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Increased knowledge and adoption of improved agricultural systems that support carbon sequestration is a primary focus of our work in climate change. Audiences were receptive to procedures and materials that will allow them to adapt to changing conditions, even as

some reject the concept that some of the practice changes are motivated by an evolving climate. Self-reported knowledge increase by 75% of program participants and the intent to apply that knowledge by 29 % of participants were the metrics selected to evaluate outcomes achieved through 35 educational events in this planned program. Deployment of anaerobic digesters and other GHG mitigation strategies on 67 farms was another measure of evaluation utilized.

Key Items of Evaluation

Approximately 75% of program participants indicated they acquired increased knowledge and skills relative to key learning objectives of this program. This measure is a calculated average of evaluations across program events where participants reported increased knowledge or skill through their participation.

Twenty-nine percent of program participants indicated an intention to use or apply one or more principles gained from 35 educational events delivered in this program area.

Sixty-seven farms employed anaerobic digestion or other methods to reduce GHG emissions or to sequester carbon.